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depôt or free distributing point of commerce between the northern states of South America and the Antilles, Europe, and the United States." It has long been a refuge for Venezuelan patriots. Bolivar, Paez, Miranda, Sublet, Guzman Blanco, Riero and other Venezuelan "revolutionists" have spent their leisure time there making plans for future action.

The cost of Curaçao to the Netherlands government is said to be between \$150,000 and \$200,000 per year more than it receives in revenues. Without this aid, even under present conditions, much difficulty would be experienced in paying the expenses of the government. If, however, the governments of Colombia and Venezuela become stable and honest and a more liberal tariff policy is adopted there seems little doubt that the trade of Curaçao will fall off to such an extent that the exporting and trans-shipping firms will be obliged to discontinue their business. Since the city of Willemstad depends largely upon this export trade for its prosperity, and the country people on the city, the effect of such a condition is obvious.

The recent trouble with Venezuela, as has been said, may be traced back to this losing fight with modern conditions. Without Venezuela's trade the island cannot prosper. The Netherlands realizing this, attempts to force Venezuela to permit the trans-shipment of goods at Curaçao. This she has succeeded in doing, but it is, at best, a temporary relief, and Curaçao will in time be obliged to yield to the inevitable and take the place that her geographic position and climatic conditions have ordained—a lonely island, with little political or commercial importance, and a small and poor population. During the transition from the unstable political and social conditions of a new continent, with its temporary lack of geographic adjustment, to those of social and political stability, Curaçao assumed an importance which will, with the progress of civilization and political integrity on the continent, soon be little more than a memory.

THE RELATION OF GEOLOGY TO TOPOGRAPHY.

BY

LAWRENCE MARTIN.

Professor D. W. Johnson and Mr. F. E. Matthes have made a strong argument in behalf of the proposition that topographers and engineers need to have geological knowledge for their guidance in constructing maps (Breed and Hosmer's "Principles and Practice of

Surveying," 1908, Vol. II, Chapter VII, 246-266, John Wiley & Sons, New York). Professor Johnson supplies the text here summarized and Mr. Matthes illustrates it with a very effective series of maps (Figures 82-95) showing good and poor methods of mapping the same region. Two of the maps are reproduced in this review by permission (Figs. 91, 92).

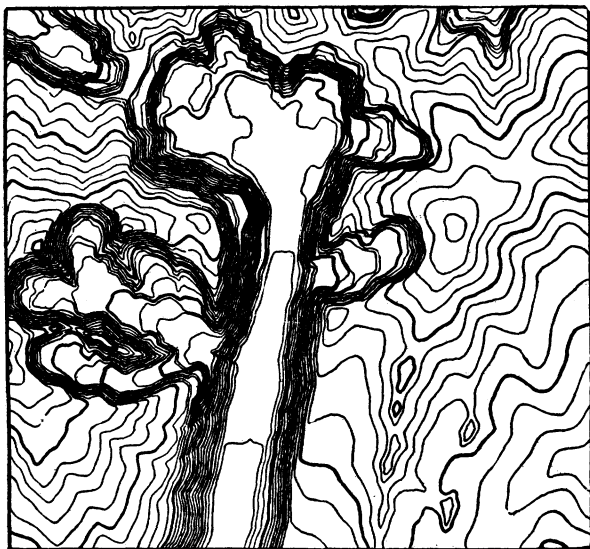
It is shown that since engineers, topographers, and other makers of relief maps are unable accurately to present on their maps the whole detail of the surface features of the areas mapped, they are compelled to generalize or sketch much of the topography and they can produce the best results only when they understand the close relation between topography and the branch of geology known as physiography. The topographer must be highly skilled in order to work adequately from a small number of accurately located points, so that he can decide what is characteristic and must be put into his sketch and what is trivial and should be left out. This involves a knowledge of land forms or, as an earlier writer has phrased it, "of the materials in which topography is cast, and of the agencies that shape it."*

Attention is called to map expression and to the ease of losing it and to the danger of drawing unnaturally rounded or unnaturally angular contours unless the topographer's eye is trained to detect the critical changes of trend and slope which a knowledge of the way the hills were formed will supply. This is illustrated by two maps drawn to show meaningless contours, in one case too rounded, in the other, too angular. The selection of an adequate scale and contour interval has to do not only with the success of the map but with its adequacy for the use intended and with the cost of preparation. As an illustration of this, the texture of topography, shown by two maps, is discussed in relation to rock, climate, and the time element and the necessity to the map-maker of a knowledge of these factors is emphasized.

It is pointed out that the working topographer, whose knowledge

* Col. Burrard and Mr. Hayden, superintendents, respectively, of the Trigonometrical Surveys and the Geological Survey of India, present the same idea in their "Sketch of the Geography and Geology of the Himalaya Mountains and Tibet," Part 2, "The Principal Mountain Ranges of Asia." They write:

"A draftsman can no more draw mountains without a knowledge of their structure than a landscape artist can draw a village scene without perspective, or than a figure painter can draw men and animals without studying their anatomy. If we attempt to cover many square yards of paper with hill-shading, without having a knowledge of the governing lines of structure, we only succeed in presenting a chaotic mass of incoherent details. * * * The difficulty in mountains is to *see*, and long experience is necessary to give the power of doing so. The untrained eye will see details readily enough, but it will miss the governing lines. In small scale representations we require the governing lines, not the details."—THE EDITOR.



CONTOUR MAP SHOWING INDEX FORMS OF ALPINE GLACIATION.

"This map indicates that the region represented has been greatly modified by Alpine glaciers, for the principal index forms of Alpine glaciation, except the lakes, are sharply brought out by the contours,"—JOHNSON.



SAME REGION AS ABOVE, POORLY MAPPED.

"This map of the same region is so far generalized that the hanging lateral valleys are lost, the Alpine character of the mountain peaks is obscured, the U-shaped cross-profile of the main valley is poorly shown, while several of the cirques have lost their most essential characteristics. The first sketch makes clear the kind of land forms to be found in the region. The second does not,"—JOHNSON.

of the origin of relief is sufficient, may develop a series of index forms that will serve as keys to the history of a whole region. These may not necessarily be prominent features, but their appreciation is essential. Alluvial fans, triangular facets on mountain spurs along a fault line, and circular rows of hogbacks to distinguish dissected, domed mountains from dissected volcanoes, are among the index forms cited. They are shown by pairs of maps in correct and incorrect form in the text-book.

The two illustrations by Mr. Matthes, reproduced in this review, showing index forms in connection with glaciated mountain areas, are far more eloquent than words. It may be well, however, to explain the significance of these figures rather more fully than the authors had space to do.

While glaciers occupy a region they deepen main valleys more than side valleys, because of superior erosive power by the larger ice tongues. When such glaciers melt away they expose the discordance between valleys and their tributaries, the latter being called hanging valleys. They are now well known in all glaciated regions of notable relief. The contours should extend straight across the mouths of such hanging valleys without bending upstream, as they do in normal valleys. The topographer familiar with this index form will draw his hanging valleys correctly, as in the upper figure. The topographer without this knowledge will represent them as in the lower figure.

Now it happens that railroads are notably affected by hanging valleys. The Delaware, Lackawanna and Western R.R., for example, had to build an awkward switchback at Ithaca, New York, to ascend into one hanging valley; the railway crossing the Alps by the St. Gotthard Tunnel had to excavate no less than seven expensive spiral tunnels because of the height of the hanging valleys there. An engineer whose topographic map did not show these features would, therefore, run grave risks in representing such hanging valleys inadequately, as scores of them have been represented on U. S. Geological Survey maps, for, if the tributary valleys had been sloping, as in the incorrect lower figure, the railway switchback and the spiral tunnels referred to would probably have been unnecessary. In the two figures one needs only compare the representation of the precipitous cirque walls, the flat valley bottoms, the oversteepened valley sides, the narrowed arretes, etc., to see what is meant by adequate and inadequate representation of these forms. It is well known now that eroding glaciers produce all these forms and they may, therefore,

serve as types for intelligent use by other topographers working in similar glaciated areas.

As proof of the validity of the arguments used by Johnson and Matthes one has only to compare the latter's splendid U. S. Geological Survey maps of glaciated forms in the Rocky Mountains, of stream work and weathering forms in the Grand Canyon of the Colorado, and of similar features in the Yosemite Valley, with poorer maps by other topographers who do not know the geology and physiography of what they map.

REGIONAL POPULATION GROUPS OF ATACAMA,* PART I.

BY

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INTRODUCTION.

The brilliant generalizations of the historian Buckle touched almost every aspect of the department of knowledge in which he laboured and the people of well-nigh every land. An extremely suggestive view which he entertained concerning the backwardness of South Americans is full of interest to-day when this phase of our neighbour's civilization is of such wide current interest. He regarded South America as peculiar, in the sense that man was overburdened, one might almost say overawed, by Nature as upon no other continent. The tropical forests are too vast, in Buckle's view, the mountains and plateaus too high, the deserts too arid, for man's successful conquest.

The intimate student of South American problems at once frames a host of objections to this sweeping generalization, for, while it can not be gainsaid that the physical conditions of that continent are of fundamental importance in the development of its people and the

* There is no single name for the west coast desert of South America. Portions of it are called the Desert of Atacama, the Pampa de Tamarugal, the Desert of Tarapacá, Tablazo de Ica, etc. Some generic term is badly needed. The phrases "the west coast desert of South America" or "the desert of Chile and Peru" are highly unsatisfactory. The former is cumbersome, the latter includes with the coast deserts the mountain and plateau deserts which are of a totally different type. I propose that the most common term and the one which now includes the largest unit of this elongated desert be used to designate the whole. Few now use the word Atacama in the restricted and precise way in which it is used in Chile. A further slight extension of its meaning would supply the much-needed term. If at any time it is desired to use the word Atacama in its old restricted sense the phrase "The Desert of Atacama *in Chile*" might be taken as a reasonable substitute.